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ABSTRACT

Although a substantial literature has addressed workplace literacy programs, only two studies have attempted to evaluate rigorously the economic benefits to workplace education. A multivariate model has been suggested that provides evidence about the productivity impacts of participation in a workplace literacy program. The data used in this paper come from two national surveys of individuals--the National Household Education Survey (NHES) and the Current Population Survey (CPS). The two data sources disagree to some extent with respect to their characterizations of the sex and ethnicity of program participants, but agree in regard to the education and household income characteristics. Both data sets show the manufacturing sector is overrepresented and the retail trade and service sector is underrepresented among participants. The majority of NHES respondents indicated that the literacy program included professional development or technical/skilled worker training. About one-third of courses met requirements toward a degree. A little over 40 percent of CPS respondents indicated the training was formal schooling. The largest share of providers for both CPS and NHES were two-year community colleges or technical institutes and about half of attendees reported employers paid, at least partially, for training. Data analyses result in estimates of marginal impacts of 11-17 percent increases in earnings but also show these impacts are not evenly distributed among program participants. (YLB)

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THE ECONOMIC PAYOFFS TO WORKPLACE LITERACY

Upjohn Institute Staff Working Paper 93-21

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THE ECONOMIC PAYOFFS TO WORKPLACE LITERACY

1. Introduction

This paper focuses on one of the potential benefits to improving the Nation's literacy—the economic payoffs. A more literate workforce provides economic benefits to the members of the workforce themselves, to employers, and to society. Workers who improve their basic skills through participation in workplace literacy programs should be more productive and hence earn higher wages and have greater job security. Employers with more productive workers will be more competitive in their industries and will be more profitable. Society gains by having a more productive and stable economy, by having more individuals employed with higher earnings and thus paying more in taxes, and by having fewer individuals unemployed who would otherwise be drawing transfer income from the government.

The key nexus in the argument that workplace literacy engenders significant economic benefits is that a more literate worker will be more productive on the job. Were that not the case, the economic benefits to workplace literacy programs would all but evaporate. Whereas literacy advocates would easily accept the notion that more literate workers are more productive, the evidence is far from clear. In fact, the status quo provides a strong counterargument. The business sector is characterized by a very low incidence of workplace literacy programs despite the fact that there is a substantial need, as measured by the percentage of the workforce who are deficient to some extent in basic skills (see Hollenbeck 1993). It can be legitimately asked why, if workplace literacy programs are so beneficial economically, is there such a paucity of programs? Why haven't more employers increased their profits by adopting such programs?

This paper presents findings that suggest that there are substantial productivity payoffs to workplace literacy programs. The answer to the question as to why there is such a low incidence of programs is that there must be market failures—such as inaccessible capital, lack of information, or uncertainty about costs or payoffs—that are dampening more widescale adoption of programs.

In the next section of the paper, I review prior literature on the economic payoffs to workplace literacy programs and suggest a model for determining their payoffs. The third section describes the data that I use to analyze the issue, which come from two national surveys of individuals. The fourth, fifth, and sixth sections of the paper present my empirical findings. In the fourth section, I analyze participation in workplace literacy programs—the characteristics of the individuals who participate.[1] The fifth section presents tabular analyses of program characteristics as reported by the participants and in the sixth section, I analyze the economic benefits to workers from participation. The final section presents conclusions.

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[1]Unfortunately, because my data come from surveys of individuals, I have virtually no information about the companies that employ the individuals.

2. *Literature/Model*

A substantial literature has addressed "workplace literacy" programs, but as Mikulecky and Lloyd (1992) indicate,

> *Only a few workplace literacy programs have been well evaluated, even though millions of dollars have been invested in their development and operation.* (p. 22)

The evaluations that have been conducted have focused mainly on cognitive outcomes. Only two studies have attempted to evaluate rigorously the economic benefits to workplace education.

Hargroves (1989) reports on a study of a program operated by the Boston Federal Reserve Bank. The bank operated a Skills Development Center for educationally disadvantaged youth that consisted of basic skills training, clerical training, and on-the-job training. This evaluation used a quasi-experimental approach, where 207 trainees between the years 1973 to 1988 were compared to 301 (non-Skill Development Center-trained) employees hired for entry-level positions. Despite the fact that the comparison group had higher levels of education and basic skills abilities, the trainees who were hired by the Fed (about two-thirds of the trainees) had longer job duration and equal earnings.

Mikulecky and Lloyd (1992) report on a study that used an approach that might be described as experimental. At two companies, they instituted a formal evaluation system that included comparison of a group of individuals who progressed through a workplace education program to a group who had signed up for such a program, but were waiting for the program to begin. While not precisely a random assignment methodology, the authors suggest that the comparison group could act as a control group. One of the purposes of this study was to pilot test the evaluation system, so the sample sizes were extremely limited. Nevertheless, the authors found that the programs at these two firms resulted in the following:

- More instances of use of reading and writing on the job
- Higher participation in meetings on the job
- Higher incidence of asking questions at work
- No significant change in job attendance, safety, or suggestions made
- Significant gain in supervisory ratings (one firm)

Model. The empirical work in this paper is comprised of tabular analyses of the characteristics of programs and participants and a multivariate model of the economic outcomes of participation. The multivariate model that is estimated provides evidence about the

productivity impacts of participation in a workplace literacy program. A standard assumption that is made in labor economics is that workers are paid an hourly wage that is equivalent to their productivity.[2] In this framework, participation in a workplace literacy program is equivalent to other types of human capital investments and are assumed to increase productivity (and thus wage rates). Mincer (1974) devised a model that has been used extensively to estimate the impact of human capital investments on the wage rate. Equation (1) presents that model.

$$(1) \qquad \log W_i = a + B'X_i + c\,WLP_i + e_i$$

where
- Wi = annual wage of worker i
- X_i = vector of characteristics describing worker i thought to be related to i's wages
- WLP_i = dummy variable equal to 1, if person i participated in a workplace literacy program and 0, if not
- e_i = error term
- a, B, c = parameters to be estimated

Under the assumption that wages are equal to worker productivity, the coefficient c is an estimate of the impact of workplace education on that productivity. If workplace literacy program participation enhances productivity, then workers will receive higher wages, and c will be positive. On the other hand, if participation does not influence productivity (or diminishes it) then c will equal 0 (be less than 0).

3. *Data*

The data used in the empirical analyses for this paper come from two large nationally representative surveys of individuals. The National Household Education Survey (NHES), a one-time survey, was conducted in 1991 by the U.S. Department of Education to estimate participation in early childhood education and adult education. The Current Population Survey (CPS) is conducted monthly by the Census Bureau for the U.S. Department of Labor to estimate the unemployment rate. The January 1991 CPS, used here, contained a supplemental survey on adult education and training.

The National Household Education Survey (NHES) collected data about two subjects—early childhood education and adult education—from a random sample of the U.S. noninstitutionalized population. It represents one of the first efforts of the U.S. Department of Education to collect education data through a random sample of households rather than from

[2]The argument is simple. If workers are paid more than the value of their productivity (defined as the value of output that can be attributed to the worker), then employers would be losing money and would go out of business. If workers are paid less than the value of their productivity, then employers would be making excess profits and other firms would enter the market and bid up workers' wages until they equaled productivity.

students, teachers, or administrators. The purpose of the adult education component of the NHES was "to measure participation in adult education activities, to describe those activities, to provide data on the characteristics of participants and nonparticipants, and to determine why some adults participate while others do not." (Brick et al., 1992, p.3).

For each individual who participated in higher or postsecondary technical education on a part-time basis or who participated in adult education, the NHES collected detailed information on up to four courses. The data set contains information on 12,568 individuals and 17,612 courses. Because the survey first screened households to identify adult education participants and then oversampled such households, it is important to adjust statistical analyses by the sampling weights that have been provided on the file.

To identify participants in adult education, the survey asked individuals whether they had participated in any of the following activities during the previous 12 months[3]:

- Continuing education courses or noncredit courses
- Courses by mail, television, radio or newspaper
- Private instruction or tutoring
- Educational or training activities given by an employer, labor organization, neighborhood center, church, or community group
- Instruction in basic skills such as math, or reading and writing English
- Instruction in English as a Second Language
- Any other organized educational activity

Respondents were asked for their main reason for taking up to four courses. The choices they were given were as follows:

- A personal, family, or social reason
- To improve, advance, or keep up to date on your current job
- To train for a new job or a new career
- To improve your basic reading, writing, or math skills
- To meet a requirement for a diploma, degree, or certificate of completion
- Other reason

In addition, if their main reason for taking a course was not job or career-related, respondents were asked whether they also had employment- or career-related reasons for taking it.

For purposes of analysis, I defined an individual to have participated in a workplace literacy program if they engaged in "Instruction in basic skills such as math, or reading and writing English" or "Instruction in English as a Second Language" and they took at least one

[3]The survey was conducted between January and May 1991, so the adult education took place between January 1990 and May 1991.

course either "to improve, advance, or keep up on your current job" or "to improve your basic reading, writing, or math skills" and they had employment- or career-related reasons for taking the course.[4]

The NHES gives considerable information about each course that respondents indicated they had taken including course name, provider, tuition and fees, and party (or parties) who paid for the course. When I examined the detailed data for those individuals who had participated in workplace literacy as defined above, I found a number of courses that were managerial or supervisory training, that were advanced academic courses such as "physical chemistry" or "foreign language", or that were based on specific computer software. I went through the data systematically and screened out such courses from my definition of workplace literacy. This eliminated about 40 percent of the observations that met the prior considerations, but left me with a sense that I had a better definition of workplace literacy participants. One last condition that I imposed on the definition of workplace literacy participation was that the individual must not have earned a bachelor's degree or higher.[5]

The CPS is the source of the official Government statistics on employment and unemployment.[6] The current sample size for this monthly survey is approximately 57,000 households containing approximately 148,000 people. Each household is interviewed once a month for four consecutive months one year, and again for the corresponding time period a year later. Although the main purpose of the survey is to collect information on individuals' employment situation, a very important secondary purpose is to collect information on the demographic status of the population, information such as age, sex, race, marital status, educational attainment, and family structure. From time to time, supplemental questions are added to the CPS on topics such as health, education, income, and previous work experience.

The January 1991 Job Training Survey was conducted as a supplement to that month's CPS. The job training questions were asked of all persons 15 years of age or older, who were members of the experienced labor force. A number of items recorded information about the skills and training workers needed to obtain their current or last job and about training received to improve their skills once on that job. One item determined the frequency that workers used reading, writing, arithmetic, and computer skills on their job. Finally, workers were asked for their opinions about the adequacy of their skills in these four areas.

Question 38 of the Job Training Survey asked experienced workers the following question:

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[4]A rigorous parsing of the workplace literacy program definition is ((instruction in basic skills such as math, or reading and writing English) or (instruction in English as a Second Language)) and ((main reason for taking course is to improve, advance, or keep up to date on your current job) or (main reason for taking course is to improve your basic reading, writing, or math skills and you also had employment- or career-related reasons for taking course)).

[5]This eliminated about 13 percent of the participants as defined by all of the preceding conditions.

[6]The material describing the CPS is taken from U.S. Census Bureau (1992).

Since you obtained your present job did you take any training to improve your skills?

If the response was affirmative, then the following question was asked:

What kind of training did you take? (Mark all that apply).

A. Reading, writing, or math skills
B. Computer-related skills
C. Other technical skills specific to your occupation
D. Managerial or supervisory skills
E. Other

Unfortunately, no additional questions were asked that named or specified with more detail the nature of the training. My first-cut at a definition of workplace literacy program participation was to include all who had taken training to improve their job skills and that training was in reading, writing, or math skills. Upon further analysis, that definition appeared to be too inclusive and so I omitted from consideration respondents who had marked "computer-related skills", "managerial or supervisory skills", or "other" in addition to "reading, writing, or math skills." I did not exclude observations who had marked both "other technical skills specific to your occupation" and "reading, writing, and math skills" because of the frequency with which workplace literacy programs are offered in conjunction with other company training in specific job skills. I did exclude individuals who indicated that they had earned a bachelor's degree or higher as I did with the NHES data.[7]

The January 1991 CPS has wage and earnings data for only about one-quarter of the sample (the outgoing rotation groups), which limits the sample size for my analyses of the wage payoffs. Nevertheless, there were an adequate number of observations to perform the model estimation as can be seen below.

The next section of the paper provides descriptive statistics concerning the survey samples and individuals who participated in workplace literacy programs, as defined above.

4. *Participation in Workplace Literacy Programs*

Table 1 describes the participants in workplace literacy programs as measured by the two surveys of individuals and defined above. The universes of the two surveys are different, and of course, the definition of participation in a workplace literacy program is quite different, as previously described. The NHES represents all individuals aged 16 or over at the time of the survey; the CPS supplement represents individuals 15 or over who had ever worked (for pay).

[7]This deleted about 38 percent of the sample who met the other conditions of the definition.

Table 1

Demographic Characteristics of Workplace Literacy Program Participants

Characteristic	Data Source: NHES Participants	NHES Total Population, 16+	CPS Participants	CPS Total Population, 15+, Ever Worked
Total Population (in 000s)	946	181,975	846	123,300
Sex				
Female	38.9%	54.8%	52.4%	45.4%
Male	61.1	45.2	47.6	54.6
Race/Ethnicity				
Black, non-Hispanic	13.8%	11.1%	13.6%	10.6%
Hispanic	30.0	7.6	7.6	7.7
White, non-Hispanic	51.3	78.7	74.9	78.6
All other	5.0	2.6	4.0	3.1
Education Level[a]				
< 12th	16.3%	19.3%	11.5%	20.1%
12th	35.5	46.6	50.8	51.8
13 - 14	{48.3	{34.0	33.9	23.5
15			3.9	4.6
Age				
≤ 30	37.6%	27.5%	32.3%	33.0%
31 - 45	46.5	32.9	41.1	40.2
46+	16.0	39.6	26.6	26.9
Region of Residence				
Northeast	12.6%	20.9%	16.3%	20.5%
North Central	30.8	24.1	24.5	24.8
South	33.9	34.2	35.1	33.8
West	22.7	20.8	24.1	21.0
Marital Status				
Married	60.0%	62.7%	60.3%	59.8%
Not Married	40.0	37.4	39.7	40.2

Table 1
(Continued)

Characteristic	Data Source: NHES Participants	NHES Total Population, 16+	CPS Participants	CPS Total Population, 15+, Ever Worked
Household Income[b]				
< $10K	11.0%	15.1%	12.2%	14.0%
10,001 - 15K	8.3	8.6	2.2	6.3
15,001 - 20K	12.9	8.9	6.6	6.4
20,001 - 25K	5.3	8.9	13.4	7.9
25,001 - 30K	8.7	9.9	6.9	7.9
30,001 - 40K	20.9	14.4	19.7	15.0
40,001 - 50K	16.7	11.7	22.9	12.9
50,001 - 75K	13.3	13.5	8.3	18.7
75,000 +	3.0	9.2	7.8	10.8

Note Entries are weighted frequencies.
[a] Since definition of workplace literacy program participation was limited to years of education ≤ 16, the total population frequencies were similarly limited.
[b] For CPS, variable is total weekly family earnings * 52.

The weights on the two data sets estimate that the universe for the NHES comprises just over 180 million people, whereas the universe for the CPS training supplement is around 120 million.

Besides the differences in the wording of the questions, the time frame of the workplace literacy program participation differed for the two data sets. The NHES referred to the 12 months previous to the time of the survey, whereas the CPS referred to the period of time, "since you obtained your present job." It is conceivable that the workplace literacy program participation of a CPS respondent occurred many years ago. Of course, it is also conceivable that an individual participated in a workplace literacy program sometime in the prior 12 months, but at a different job, which would not have been included in our definition.

Nevertheless, the more general definition and the more general time frame suggest that the CPS estimate of the proportion of the population who had been workplace literacy program participants would exceed the NHES estimate and, indeed, that is the case. The CPS estimate is about 0.7 percent of its universe (or about 850,000 individuals), whereas the NHES estimate is just over 0.5 percent (or about 950,000 individuals).

Besides the difference in the percentage of participants, table 1 presents some differences in the socioeconomic characteristics of the participants as tabulated from the two data sources. The NHES sample suggests that, relative to the total population, workplace literacy participants tend to have the following characteristics:

male
black, non-Hispanic ethnicity
Hispanic
some postsecondary education
aged less 46
residence in the North Central Census region
middle income ($30,000 - $50,000)

The CPS tabulations suggest that, relative to the total population, workplace literacy participants tend to have the following characteristics:

female
black, non-Hispanic ethnicity
some postsecondary education
middle income ($30,000 - $50,000)

The two data sources disagree to some extent with respect to their characterizations of the sex and ethnicity of program participants (the NHES indicates that males and minorities, particularly Hispanics, are disproportionately represented, whereas the CPS indicates that females are disproportionately represented, but that the ethnicity of the participants resembles the population). However, the data sources are in agreement with the education (some schooling beyond high school) and household income (between $30,000 - $50,000) characteristics.

Table 2 presents the industry and occupational distributions of workplace literacy program participants as measured by the NHES and CPS. There is considerable similarity in the two data sets. Both show that the Manufacturing sector is overrepresented among participants—in the NHES, almost a third of the participants reported themselves to be in that sector, whereas in the CPS, about one-quarter were in that sector. On both data sets, only about one-sixth of the entire universe reported employment in Manufacturing. Both data sets show that the Retail trade and Service sectors are underrepresented among participants. About 10 percent of program participants work in Retail trade, whereas over 15 percent of the workforce is in that sector. One-third of the labor force works in the Services sector, but the two surveys indicate that about 22 percent (NHES) or 30 percent (CPS) of participants are in that sector. The two surveys also show relatively low participation in the Agriculture, forestry, and fishery and Mining sectors and relatively high participation in the Construction and Government sectors.

The occupational distributions follow closely the industrial sector distributions.[8] The two surveys report underrepresentation in Marketing and sales occupations (recall the relatively low participation in the Retail trade sector); Service occupations; Agriculture, forestry, and fishery occupations; Executives, administrators, and managers; and Professional and technical occupations. Occupations with a relatively high level of participation include Construction and

[8]Actually, occupation is probably a more important determinant of participation, and so it would be more correct to say that the industrial sector distributions follow from the occupational distributions.

Table 2

Industry and Occupation of Employment of Workplace Literacy Program Participants

Characteristic	Data Source: NHES Participants	NHES Total Population, 16+[a]	CPS Participants	CPS Total Population, 15+, Ever worked[a]
Industry				
Ag., for., fish.	0.0%	3.2%	0.6%	2.7%
Mining	0.0	0.8	0.1	0.7
Construction	9.0	4.6	6.6	6.5
Manufacturing	30.8	17.2	23.7	18.1
Trans., commun., public utilities	1.6	6.4	8.6	7.0
Wholesale trade	5.9	1.7	3.2	3.7
Retail trade	10.7	15.4	10.3	17.0
Finance, insur., real estate	5.7	5.9	10.3	6.7
Services	22.2	33.4	30.8	33.0
Government	14.1	11.4	6.0	4.6
Occupation				
Exec., admin., mgr.	1.3%	4.6%	7.1%	12.5%
Professional, technical	3.7	12.1	6.5	11.4
Health-related technicians	4.1	3.8	4.2	3.0
Engineering, scientific tech.	2.1	1.0	3.2	2.1
Marketing, sales	10.1	11.6	8.4	12.0
Admin. support, clerical	29.5	25.4	22.5	15.6
Service occs.	10.8	16.6	13.7	13.8
Ag., for., fish.	0.0	2.6	0.5	2.6
Mechanics/repairers	2.9	3.0	7.8	3.8
Construction, mining	7.1	3.5	5.9	4.5
Precision production	3.5	1.4	5.0	3.3
Labor, transp.	25.0	14.4	15.4	15.4

Note Entries are weighted frequencies.

[a] Total population frequencies limited to observations with reported industry or occupation of current or most recent job.

mining (presumably Construction); Precision production; and Labor and transportation occupations. Together these three occupations include about 19 percent of the labor force, but over one-third of literacy program participants.

In short, a profile of workplace literacy program participants suggests that they have a 12th grade or higher education and middle-level income—between $30,000 - $50,000 per year. The NHES data set further indicates that participants are more likely to be male and, disproportionately, of minority ethnicity (particularly Hispanic). However, the other data set that I examined, the CPS, indicates more females and relatively more blacks. In the CPS, Hispanics are almost exactly representative of the in-population percentage, however.[9]

The next section of the paper relates details about characteristics of the programs in which individuals participated.

5. Characteristics of Programs

Table 3 provides data that describes the workplace literacy program "courses" as reported by the NHES respondents. The first characteristic in the table refers to responses to a question about whether the courses involved "employment- or career-related training." The majority of respondents indicated that the (literacy program) course included "Professional development" or "Technical/skilled worker" training. Other significant responses included "Quality control" (over one-third of the responses) and "Supervisory" (about 30 percent).

About one-third of the courses met requirements toward a degree. Of these, most were toward a vocational diploma beyond high school. About 13 percent of the courses were reported to meet requirements toward a license or certificate in a trade.

About one-third of the courses were provided by educational institutions (about half of these were at 2-year colleges or technical institutes and the other half were spread across elementary or secondary schools, 4-year postsecondary institutions, or proprietary vocational/trade schools). A little over 40 percent of the courses were provided by business/industry/labor and the remaining courses were provided by a government agency, private tutors, or others. Some of the respondents were employed by educational institutions or government agencies because just over half of the respondents indicated that the provider was their employer. In that case, over 80 percent of the respondents noted that the "course" was limited to employees.

Almost 90 percent of the respondents indicated that they took the course while being employed. The other 10 percent took the course on a pre-employment or layoff basis. For the respondents who were employed, over half were given time off to attend the training, about 40 percent took the course at the work site, and about one-third were required to take the training.

Just over 10 percent of the respondents reported that there were no costs associated with their course. About a fourth of the respondents indicated that <u>they</u> (or their family) had paid for

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[9]I assume that the NHES found a much higher percentage of respondents who had engaged in ESL classes than did the CPS. This may suggest coverage difficulties with the CPS.

Table 3
Characteristics of Workplace Literacy Programs (from NHES)

Characteristic	Percent Yes	Percent No	Mean
Type of training (mark all that apply)[a]			NA
Exec. or mgmt. development	28.4	71.6	
Supervisory	30.1	69.9	
Professional development	56.5	43.5	
Technical/skilled worker	58.0	42.0	
Computer software	26.8	73.2	
Health & safety	28.4	71.6	
Quality control	36.8	63.2	
Sales/marketing	14.9	85.1	
New employee	19.6	80.4	
Other	2.1	97.9	
Did training meet requirements toward a degree?	32.3	67.7	NA
If yes: High school diploma	15.5%		
Voc. diploma > h.s.	53.4		
2-yr. degree	13.8		
4-yr. degree	6.9		
Grad./prof. degree	5.2		
License/other	5.2		
Did training meet requirements toward a license/certificate in a trade?	13.0	87.0	NA
Provider (Mark one response)[b]			NA
Elem./sec. school	8.5%		
2-yr comm. coll./tech. inst.	19.7		
4-yr college	5.9		
Voc/trade school	5.3		
Tutor/private	1.6		
Business/industry	34.0		
Labor	6.9		
Govt agency	13.8		
Other	4.3		
Was provider your employer?	50.5	49.5	NA
If yes: Was program limited to employees?	83.5	16.5	

Table 3
(Continued)

Characteristic	Percent Yes	Percent No	Mean
Were you employed at time of training?	89.1	10.9	NA
If yes: Was training at work site?	44.4	55.6	
Was training req'd?	33.9	66.1	
Were you given time off to attend?	53.8	46.2	
Was there a cost for the training?	89.5	10.5	NA
If yes: Who paid?[c] (Mark all that apply)			
Business/industry	48.8	51.2	
Family/self	27.3	72.7	
Fed. govt.	15.9	84.1	
Private comm. org.	4.7	95.3	
State govt.	14.3	85.7	
If yes: Did your employer bear any cost?	63.5	36.5	
Did you complete?	74.7	25.3	NA
If no: Still taking?	72.3	27.7	
Hours[d]	NA	NA	80.3
Tuition paid by family/self[e]	NA	NA	$211

Note Percentages based on number of responses to question. Total number of courses comprising workplace literacy program = 194.

[a] Respondents were asked following question: "Did (course) includeany of the following types of employment or career-related training: (Mark all)."

[b] Respondents were asked following question: "Who offered the instruction for (course), as opposed to who sponsored or taught the class? (Mark one)."

[c] Respondents were asked following question: "Who paid for you to take (course)? (Mark all)."

[d] Mean product of weeks scheduled and hours per week scheduled to attend (non-zero and nonmissing responses only).

[e] Mean for non-zero entries only. Universe limited to respondents who indicated that family/self paid for training.

the course. Among these, the average reported tuition was $211. Governmental sources paid for another quarter of the courses and business/industry paid for almost all of the remainder, that is, about half of the cases where there was a charge.

Three-quarters of the workplace literacy program participants had completed their participation. Among the one-quarter who did not complete, about 70 percent were still participating and 30 percent had stopped participating without completion. On average, the "courses" that these respondents were providing descriptions were scheduled to require 80 hours.

The CPS provided somewhat less data about the actual program characteristics. Table 4 summarizes the responses to that survey. A little over 40 percent of the respondents indicated that the training was formal schooling; about one-third indicated that the training comprised formal company training; slightly more than a third indicated that it was informal, on-the-job

training; and just under 10 percent indicated that it was some other form of training (like correspondence courses, private tutoring, etc.).

Table 4
Characteristics of Programs (from CPS)

Characteristic	Percentage
Type of Training (Mark all that apply)	
School-based training	42.6
Formal company training	33.1
Informal OJT	36.3
Other	9.2

School-based Training		Formal Company Training	
Characteristic	Percentage	Characteristic	Percentage
Length of training (n=161)		Length of training (n=127)	
≤ 1 week	8.7	≤ 1 week	36.2
2-12 weeks	24.2	2-12 weeks	37.8
13-25 weeks	18.6	13-25 weeks	9.4
26+ weeks	48.4	26+ weeks	16.5
Government-funded (n=161)		Government-funded (n=126)	
Yes	4.3	Yes	3.2
No	88.2	No	88.9
Don't know	7.5	Don't know	7.9
Provider (n=203)		Provider (n=120)	
High school vocational program	9.9	Apprenticeship program	10.0
Post-high school voc. program	10.8	Training office of the company	81.7
Jr./comm. college or tech. institute	43.3	Joint labor/mgmt. program	8.3
4-yr. college/university	17.2		
Employer share of costs (n=165)			
100%	37.6		
50-99	9.7		
1-49	1.2		
0%	51.5		
Did employer give timeoff? (n=162)			
Yes	29.6		
No	70.4		

Note Entries are unweighted distributions from CPS supplement for individuals who answered the questions.

The CPS only asked for additional information if the training were school-based or formal company training. The former, as might be expected, comprised lengthier programs. About two-thirds of the school-based programs lasted 13 or more weeks, whereas only about one-quarter of the formal company training programs lasted 13 weeks or more. Only a small portion of either type of training, 10 percent or less, was funded by a government agency.

The CPS and NHES are consistent with respect to two aspects of school-based training. The largest share of providers (about half) were two-year community colleges or technical institutes and about half of the attendees reported that their employers paid, at least partially, for the training. The CPS indicates that only about 30 percent of the school-based program attendees were given timeoff to attend. The NHES data about betting timeoff from the respondent's employer (which indicates slightly over half were given timeoff) comes from the entire sample and so it is not comparable data.

Having examined participant characteristics and program participation behavior in the previous section of the paper and having examined program characteristics in this section, the final analyses looks at the outcomes in the form of economic payoffs.

6. Wage/Productivity Payoffs

Equation (1) presents the basic human capital model that was estimated in order to determine whether or not participation in workplace literacy programs paid off for individuals in the form of higher wages or earnings. By adopting the usual assumption made in labor economics that wages are perfectly correlated with productivity, then the results of this econometric modeling will relate participation to productivity as well.

Table 5 presents the estimates. The first panel of the table comes from the NHES data set and the second panel from the CPS. On both data sets, the model was estimated for the total population and separately, by sex. All models were estimated with and without a set of industry and occupation dummy variables. By examining coefficients across the models with and without industry and occupation, we can see the extent to which industry or occupation choice mediates the payoff to workplace literacy program participation and the payoff to other characteristics as well. For example, suppose there is a positive effect of program participation without the industry and occupation variables, but no program effect when these variables are included. This means that the program effect is spurious. In this case, we would conclude that industry and occupation determine peoples' wages at the margin, and it is the way that workplace literacy program participants are distributed across industries and occupations that makes it appear as if program participation pays off.

The demographic variables of sex and ethnicity are included in the model to capture any wage or earnings discrimination as well as gender-related unobserved variables that may influence earnings. Because the dependent variable is the logarithm of earnings, the coefficients can be interpreted as percentage impacts. Women have earnings that are 30 - 40 percent lower than men and black males have earnings that are 15 - 20 percent lower than white males. Interestingly, other things equal, minority women earn about 6.5 percent more than white women.

Table 5
Estimates from a Model of the Economic Payoffs
from Participation in Workplace Literacy Programs

Characteristic	Population/Model: Total Population 1	Total Population 2	Males 1	Males 2	Females 1	Females 2
Panel a: NHES, Dependent Variable is log(annual earnings)						
Female	-.450*** (.013)	-.424*** (.014)	--	--	--	--
Minority	-.070*** (.017)	-.016 (.017)	-.194*** (.025)	-.150*** (.024)	.015 (.024)	.065*** (.023)
Married	.044*** (.016)	.028* (.015)	.213*** (.025)	.189*** (.024)	-.057*** (.020)	-.073*** (.020)
Children < 16	-.045*** (.017)	-.045*** (.016)	-.008 (.024)	-.013 (.023)	-.165*** (.023)	-.142*** (.022)
South	.007 (.014)	-.008 (.013)	-.036* (.019)	-.044** (.018)	.029° (.019)	.006 (.018)
Homeowner	.047*** (.015)	.042*** (.014)	.105*** (.022)	.094*** (.021)	.017 (.020)	.033* (.019)
Age[a]	.014*** (na)	.014*** (na)	.013 (na)	.027 (na)	.028*** (na)	.025*** (na)
Urban	.153*** (.015)	.118*** (.015)	.226*** (.021)	.183*** (.021)	.129*** (.021)	.079*** (.020)
Years of education	.071*** (.003)	.049*** (.003)	.056*** (.004)	.033*** (.004)	.079*** (.004)	.054*** (.004)
Current FT student	-.390*** (.025)	-.352*** (.024)	-.440*** (.036)	-.397*** (.035)	-.363*** (.034)	-.320*** (.033)
Current PT student	.090*** (.032)	.069** (.030)	.091* (.047)	.075* (.044)	.098** (.042)	.064° (.040)
Workplace literacy program participant	.169* (.085)	.128° (.081)	.208** (.102)	.191** (.096)	.100 (.140)	.018 (.133)
Industry and occupation dummies	No	Yes	No	Yes	No	Yes
$\bar{R}^2$	.2590	.3273	.2664	.3460	.1629	.2470
Dep. variable mean	9.66	9.66	9.92	9.92	9.44	9.44
n	11,483	11,483	5,111	5,111	6,372	6,372

Table 5
(Continued)

Characteristic	Population/Model: Total Population 1	Total Population 2	Males 1	Males 2	Females 1	Females 2
Panel b: CPS[b], Dependent variable is log(weekly earnings)						
Female	-.382*** (.010)	-.320*** (.011)	--	--	--	--
Minority	-.063*** (.014)	-.022* (.013)	-.156*** (.019)	-.107*** (.018)	.033° (.021)	.065*** (.019)
Married	.099*** (.012)	.064*** (.011)	.164*** (.018)	.111*** (.017)	.007 (.017)	-.003 (.015)
Children < 16	-.113*** (.012)	-.096*** (.011)	-.043*** (.016)	-.032** (.015)	-.229*** (.017)	-.197*** (.016)
Homeowner	.025** (.011)	-.011 (.010)	.062*** (.015)	.029** (.014)	.001 (.017)	-.042*** (.015)
Work experience[a]	.027*** (na)	.022*** (na)	.032*** (na)	.028*** (na)	.021*** (na)	.019*** (na)
Years of education[a]	.116*** (na)	.084 (na)	.112*** (na)	.082 (na)	.118 (na)	.082 (na)
Workplace literacy program participant	.113** (.054)	.080° (.050)	.014 (.075)	-.042 (.071)	.171** (.076)	.142** (.070)
Industry and occupation dummies	No	Yes	No	Yes	No	Yes
$\bar{R}^2$	.4121	.4977	.4447	.5163	.3245	.4360
Dep. variable mean	5.84	5.84	6.04	6.04	5.62	5.62
n	15,096	15,096	7,744	7,744	7,351	7,351

Note Entries are coefficient estimates from weighted OLS regressions. Standard errors are in parentheses.
[a] These variables were entered as quartics in the models. Table entries represent marginal effects evaluated at sample means. Statistical significance is shown if all four coefficients were significant.
[b] Sample comes from outgoing rotation groups only—approximately one-quarter of the total CPS sample.

*** Significant at the .01 level.
** Significant at the .05 level.
* Significant at the .10 level.
° Significant at the .15 level.

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The family status variables—marital status and presence of children—are in the model for reasons that are similar to their inclusion in the participation equation. For women, particularly, marriage and presence of children are expected to be negatively correlated with earnings. This is because married women and women with children have less workforce experience and labor force attachment than comparable unmarried women or women without children. For men, marriage is expected to be positively related to earnings. The coefficients in the table bear out these predictions.

Residing in the South and in urban areas are in the model to pick up geographic effects on wages and earnings. The estimates suggest that earnings in the South are lower than the rest of the country by about 3-4 percent and that urban earnings levels are 11-20 percent higher than non-urban earnings. Being a homeowner should indicate a higher attachment to the labor force and higher earnings, and indeed, this is what is shown in the table.

Age is a proxy for work experience in the NHES data set, whereas experience (age-education-6) is entered directly in the CPS. In both data sets, an additional year of experience results in 2-3 percent higher earnings. Years of education are also highly related to earnings. In the NHES results, an additional year of education results in 6-8 percent higher earnings, whereas an additional year of education results in 8-11 percent higher earnings on the CPS.

Theoretically, since workplace literacy program participation is a form of human capital enhancement, I expect its coefficients to be positive. Table 6 extracts the coefficients on program participation from the previous table and presents them in percentage terms. When the models are estimated over the entire population, workplace literacy program participation is estimated to increase earnings by about 17 percent (NHES) or 11 percent (CPS). These are substantial impacts. Part of the impacts come from the industries and occupations of participants; however they remain substantial even when industry and occupation are controlled in the model: the payoffs drop to 13 percent (NHES) and 8 percent (CPS).

However, because the coefficients on the control variables in the models differ across sexes, I have less confidence in the constrained model estimated over the total population. The estimates in the final four columns of the table are more appropriate. Unfortunately, the two data sets present quite different results. The estimates from the NHES data set show that males receive a 20 percent higher earnings payoff from participation in literacy programs than otherwise identical males who do not participate that is hardly eroded when industry and occupation controls are added to the model. In the CPS estimates, however, males are shown to receive no payoff (i.e., the payoffs are not statistically different from zero).

On the other hand, from the CPS estimates, women receive a 14-17 percent earnings payoff that, again, hardly changes when industry and occupation are added to the model. But on the NHES, the payoffs for women, while positive, are not statistically significant.

Table 6
Estimates of the Marginal Economic Effects
from Workplace Literacy Program Participation

	Population/Model					
	Total Population		Males		Females	
Dependent Variable	1	2	1	2	1	2
Percentage increase in annual earnings (from NHES)	16.9*	12.8°	20.8**	19.1**	10.0	1.8
Percentage increase in weekly earnings (from CPS)	11.3**	8.0°	1.4	-4.2	17.1**	14.2**

Note: Entries are coefficient estimates from weighted OLS regressions, expressed as percentages. Full models are reported in table 5. The models in column 1 exclude industry and occupation, whereas industry and occupation dummy variables are included in 2.

** Significant at the .05 level.
* Significant at the .10 level.
° Significant at the .15 level.

How can the discrepancies in the estimates from the separate data sets be resolved? First of all, part of the differences may be explained by differences in the outcome variables. The NHES uses annual earnings, whereas the CPS uses weekly earnings. If men who participate in literacy programs work more weeks per year than nonparticipants, but women who participate work fewer weeks per year, then the coefficients would be more consistent than they appear. However, we cannot put much confidence in this explanation of the discrepancies because participants are such a small percentage of the overall labor force and there is no obvious explanation as to why male participants would work more weeks per year than nonparticipants, whereas women participants would work fewer weeks per year.

A second explanation that seems more plausible is that economic payoffs to programs are not automatic, but rather depend on the literacy program characteristics and employer/firm characteristics. If this explanation is correct, it must be the case that the NHES happened to sample relatively more males in the programs/firms that have successful attributes and the CPS happened to sample relatively more females in successful programs.

A final explanation is that the sample designs or implementation of the two surveys resulted in discrepant data by chance. After all, the event of interest, workplace literacy program participation, is only observed in a small number of cases and the differences in demographic characteristics and participation behavior may be well within sampling error. The models that were estimated may be "correct" and if they were estimated on different data, they would yield results that are consistent across gender.

A potential threat to the validity of the model and estimates presented here is selectivity bias. Slightly less than one percent of the samples participated in workplace literacy programs and it may be the case that these observations are a select group, and not representative of the entire sample. It may be the case that there is some unobserved or unobservable quality about these individuals that is correlated with earnings. For example, participants may have more "initiative" or the firms that employ participants may have made investments in physical capital at the same time that they conducted the workplace literacy program. Unfortunately, statistical procedures to adjust the regression coefficients for selectivity were inadequate because of data limitations.[10]

7. Conclusions

The good news for literacy advocates is that table 6 exhibits estimates of substantial payoffs to participation in workplace programs. The analyses of data from two large, nationally representative surveys of individuals result in (unbiased) estimates of marginal impacts of 11-17 percent increases in earnings, and by implication, productivity. Part of these impacts are due to the particular industries and occupations of participants. But even when these are controlled, the impacts lie in the 8-13 percent range.

The analyses, however, shows that these impacts are not evenly distributed among program participants, so that one cannot assume that all participants will experience such outcomes. Analysis of one data set found that the payoffs to programs accrued to males and not to females, whereas the other data set found just the reverse. An explanation for this discrepancy is that the economic payoffs from program participation depend on program and employer characteristics that were not observed in these data sets. Important further work in this field must wait until data sets are available that have information on all three elements in the equation—individual participant, program characteristics (including provider), and employer/firm characteristics.

The inescapable conclusion is that, on average, large economic payoffs to workplace literacy program participation accrue for a substantial share of participants. Workers are receiving higher earnings, and are more productive. Since only a very small number of businesses have conducted programs, it can be inferred that many employers and society as a whole are missing out on the economic benefits that can be gained from offering/encouraging such

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[10]In addition to the models reported in the text, models that would control for self-selection of program participants were estimated. In these models, participation in workplace literacy programs is first estimated by probit analysis and then the Mills ratio from that first
stage is added as a regressor in the earnings models. Alternatively, the predicted probability of participation was used as a regressor in a 2SLS procedure. These estimates are not reported because the coefficients were extremely volatile to specification and estimation technique. Furthermore, the coefficients on workplace literacy program participation (or predicted participation) were implausible.

programs. Policymakers need to overcome market failures that are likely presenting barriers to employers—inaccessibility to capital and insufficient information about costs and benefits.

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